XXXVII.—*The Systematic Position of the Burmese Fish* Chaudhuria. By N. Annandale, D.Sc., F.A.S.B., Director, and Sunder Lal Hora, D.Sc., Assistant Superintendent, Zoological Survey of India.

[In 1918[*] I described a minute eel-like fish from the Southern Shan States which I called *Chaudhuria caudata* and regarded as a type of a distinct family (Chaudhuriidæ) of primitive Apodes. Mr. Whitehouse[†] at the same time was kind enough to prepare an account of the structure of the tail, which in his opinion was that of a typical eel. Shortly afterwards, Mr. Tate Regan wrote to me pointing out that in certain respects my description and figures indicated that *Chaudhuria* was rather related to *Mastacembelus.* He courteously invited me to re-examine my material. This I was unable to do at the time, as I was just starting for Eastern Persia on special war work. Mr. Tate Regan[‡], therefore, published a note definitely assigning my genus to the Opisthomi.

On a second visit to the Inlé Lake early in 1922, Dr. Sunder Lal Hora and I obtained abundant fresh material of *Chaudhuria.* This we have examined anatomically, comparing it in detail with specimens of *Mastacembelus.*—N. A.]

In order to discover the exact taxonomic position of *Chaudhuria* we have paid special attention to the skull, the pectoral girdle, the gross structure of the alimentary canal, and the air-bladder.

External characters.—We have nothing to add to or change in the original description, except as regards the existence of scales. These were said to be present and described as minute and buried in the skin. Re-examination of both old and new preparations convinces us that this was an error. In certain regions there is a kind of reticulation in the pigment, but no true scales appear to exist.

Skull.—In dorsal view (fig. 1, A) the skull only differs from that of *Mastacembelus* in the relative proportions of the various bones, in the great development of the otic region, and in the fact that the occipital region is nearly horizontal. The ethmoid is slightly expanded on either side in front, and its lateral posterior region projects strongly on either side in the form of an acute triangle. The nasals are large and expanded. The frontals are large and broad, with the orbital margin strongly sinuate, but with a greater part of the lateral outline straight and almost parallel on the two sides. The central suture is slightly sinuate in front, but not otherwise asymmetrical. Posteriorly the two bones form a broad transverse suture on either side with the parietals and a somewhat narrower oblique suture with the supraoccipital. The parietals are of relatively large size and of subquadrate form, considerably longer than broad. They are rather widely separated from the margin of the skull, except at the antero-lateral angle, by the greatly enlarged and inflated pterotics. The sphenotics are not visible in this view. The epiotics are well developed, but rather narrow, and a comparatively large triangular process of the exocciptal is visible from above and runs forwards for at least two-thirds of the distance from the posterior margin of the skull to the antero-central angle of the epiotic. The supraoccipital is very large and is separated into two distinct regions—a subcircular anterior region, contained between frontals and the anterior half of the parietals, and a posterior vase-shaped region of about three times the length of the anterior part and occupying a little more than a third the breadth of the skull. The inflation of the periotic capsules gives the posterior region

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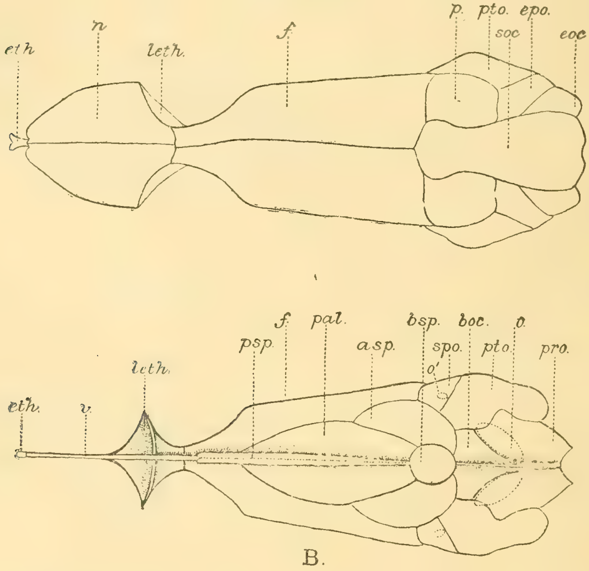
[*] Annandale, Rec. Ind. Mus. xiv. p. 40, pl. i. fig. 1; pl. iv. figs. 1–10 (1918).

[†] Whitehouse, Rec. Ind. Mus. xiv. p. 65 (1918).

[‡] Regan, Ann. & Mag. Nat. Hist. (9) iii. p. 198 (1919).

Fig. 1.



Chaudhuria caudata. Skull: A, dorsal view; B, ventral view.

asp., alisphenoid; *boc.*, basioccipital; *bsp.*, basisphenoid; *eoc.*, exoccipital; *epo.*, epiotic; *eth.*, ethmoid; *f.*, frontal; *leth.*, lateral region of ethmoid; *n.*, nasal; *o.*, *o.'*, otoliths; *p.*, parietal; *pal.*, palatine; *pro.*, prootic; *psp.*, parasphenoid; *pto.*, pterotic; *soc.*, supraoccipital; *spo.*, sphenotic; *v.*, vomer.

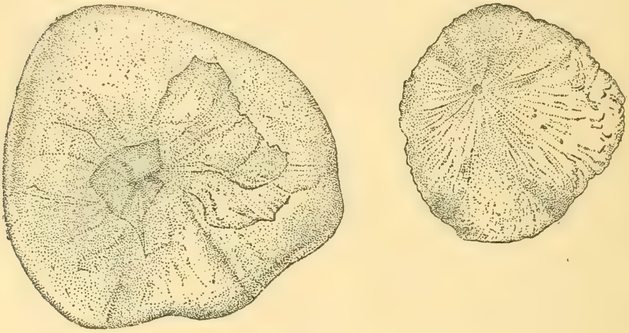
of the skull a very characteristic appearance in this view. The bones are transparent and the semicircular canals are very conspicuous through them, rendering it difficult to see the limits of the different bones without very careful examination under a fairly high power of the microscope. The posterior margin of the skull is as broad as the maximum transverse diameter of the frontal region.

In lateral view there is nothing very particular to be noted which is not also seen in the dorsal view, except that the sphenotic bone is conspicuous.

In ventral view (fig. 1, B: the nasals omitted) the nasal region only differs from that of *Mastacembelus* in the outlines and proportions of the bones, and in that the anterior expansion of the ethmoid is distinctly visible. The lateral expansions of this bone bear a strong ventral ridge, which extends outwards and forwards from the junction of the vomer and the ethmoid. The vomer resembles that of *Mastacembelus*, and runs into the parasphenoid about the same point. The palatines, however, are much larger and situated further backwards, distinctly behind the orbits. Each forms practically a sector of a circle considerably less than a semicircle, and is joined to the alisphenoid by a long suture. The parasphenoid forms a long narrow ridge with a distinct median longitudinal groove, which gives the bone the appearance of being paired. Behind it a basisphenoid is present in the form of a comparatively large, flat, circular bone, which forms a suture with the palatines, alisphenoids, and basioccipital. The alisphenoids are also large, broad, and flat. They are nearly semicircular in outline. The sphenotic in this view is conspicuous, forming an irregular subquadrate plate, through which the smaller of the two otoliths can be seen by transparency. The pterotic, which is greatly inflated and has an irregular outline, is the largest bone in this part of the skull. The prootic is also relatively large and considerably inflated. The larger of the two otoliths is conspicuous by transparency through its anterior inner region, extending below the pterotic for a short distance and lying in the sacculus in a prominent capsule composed of the two bones. The basioccipital is very narrow between the prootics, where it consists of a prominent ridge. This ridge extends forwards to the posterior margin of the basisphenoid, which separates it from the parasphenoid ridge. On either side the bone expands in front into a broad plate of irregular outline in contact with the prootic, pterotic, alisphenoid, and basisphenoid.

Two otoliths (fig. 2), as we have already indicated, are present on either side of the skull. Both are relatively large, and both have a somewhat similar outline, but one, apparently the sagitta, which lies in the sacculus, is about twice the size of the other. Both are subcircular in outline, but somewhat irregular, flat on one surface and raised on the other into a slight eminence, which is eccentric in position. They are formed of very dense white calcareous matter.

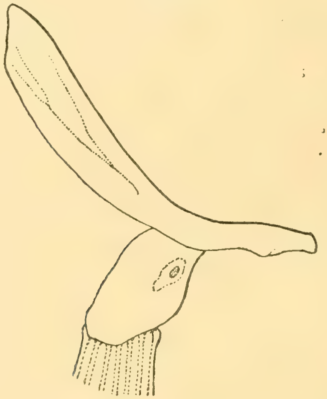
Fig. 2.



Chaudhuria caudata. The otoliths.

Shoulder-girdle (fig. 3).—There is no post-temporal, and the supracleithrum is completely fused with the cleithrum. The girdle is attached to the vertebral column by a ligament. The primary girdle is degenerate and very imperfectly ossified, the bones consisting of a single honeycombed mass, sometimes with independent islets present at the margin.

Fig. 3.



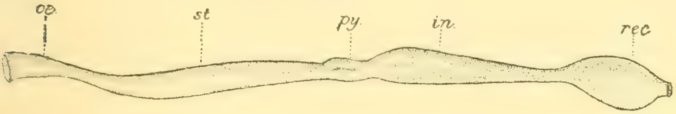
Chaudhuria caudata. Shoulder-girdle.

No distinct elements can be detected with certainty, but there is a large and conspicuous perforation in the region that may be taken to represent the hypercoracoid *. The radials are not differentiated.

Pharyngeal bones.—The pharyngeal bones resemble those of *Mastacembelus*, and bear numerous sharply pointed recurved teeth.

Caudal fin.—We have nothing to add to Whitehouse's description (*op. cit.*) of the caudal fin, except to point out that the upper part of the hypural projects further than the lower, giving the tail a slightly heterocercal form, as is well shown in the figure in Whitehouse's paper and on plate i. of Annandale's account of the fishes of the Inlé Lake (*op. cit.*).

Fig. 4.



Chaudhuria caudata. Alimentary canal.

Alimentary canal (fig. 4).—The alimentary canal consists of a straight or almost straight tube, extending from the mouth to the anus and without pyloric appendages. The œsophagus, which is narrowly funnel-shaped, passes gradually into the stomach, which is long and tubular. The pylorus is a still narrower and very much shorter tube, and opens into the intestine directly without curvature when empty ; but when it is dilated, owing to the presence of the remains of food or of parasites, a slight curvature can be detected. The intestine is quite straight, and is swollen towards the end to form a rectum. The anus is surrounded by a series of small tubular glands. The liver is very large, and so is the gall-bladder.

Air-bladder.—The air-bladder resembles that of *Mastacembelus*, being a long tubular structure lying immediately below the vertebral column. The walls of the posterior extremity in some specimens are thickened for a short distance, and this region is marked off in such individuals by a narrow transverse constriction. In others, however, it is apparently homogeneous in structure and not constricted. In our preparations we have not been able to find any definite connection between the bladder and the auditory apparatus.

Gonads.—Most of the specimens we have dissected are females. The ovaries are very large and occupy a great part of the body-cavity. They contain eggs in many different stages of development mingled together. The eggs have already been described and figured by Annandale (*op. cit.*). We found a single male, in which the testes were comparatively small, the one on the right side being a little longer than the other. They formed a pair of flat band-shaped bodies joined together along the middle line and having a short stout duct which opened beside the anus into a cloaca.

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* Regan, Ann. & Mag. Nat. Hist. (8) ix. p. 219 (1912).

The facts stated above show clearly enough in our opinion that Mr. Regan (*op. cit.* 1919) was right in postulating a relationship between *Chaudhuria* and *Mastacembelus*. The special points of resemblance are :—

(i.) The general form and facies of the whole animal and of the skull.
(ii.) The structure of the unpaired fins and to some extent of the pectoral girdle.
(iii.) The absence of any trace of pelvic girdle and fin.
(iv.) The structure of the jaws and the anterior part of the skull.
(v.) The supraoccipital separating the parietals.
(vi.) The presence of the same elements in the otic capsules,
and other minor points.

Points iv. and v. clearly indicate that the genus cannot be retained in the Apodes.

There are, however, several important differences between *Chaudhuria* and *Mastacembelus*, not only in external characters, but also in the structure of the skull, the upper part of the shoulder-girdle, and the alimentary canal. Those in the primary pectoral girdle are probably of less importance, although this part of the skeleton does not altogether conform to Mr. Regan's definition of Opisthomi (*op. cit.* 1912). The main points in which his definition of the order will have to be amended, if *Chaudhuria* is to be included, are the following :—

(i.) The absence of scales.
(ii.) The absence of a fleshy tentacle on the snout.
(iii.) The absence of spines from the fins.
(iv.) The presence of a basisphenoid.
(v.) The smaller number of vertebræ.
(vi.) The complete fusion of the supracleithrum and the cleithrum.
(vii.) The degenerate character of the primary shoulder-girdle.

Of these we consider points ii., iii., and especially iv. and vi. the most important. The absence of scales, etc., is probably due to degeneration. Another important character is the condition of the alimentary canal. It differs from that of *Mastacembelus* and *Rhynchobdella*[*] in the absence of cæcal pyloric appendages, and in its straight course and simple structure.

All these points, considered together, we regard as quite sufficient justification for retaining the family Chaudhuriidæ, which we may redefine as follows:—Minute and probably degenerate Opisthomi devoid of spines in the fins, of a fleshy tentacle on the snout, and of scales; with a basisphenoid in the skull; with the otic capsules of exceptionally large size and complex structure; with the supracleithrum and cleithrum completely fused together, and with the elements of the primary shoulder-girdle degenerate and barely distinguishable; with the alimentary canal almost straight and devoid of pyloric appendages.

XXXVIII.—*Preliminary Descriptions of Three new Parasitic Nematodes.*

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The following new forms occurred among material belonging to the Zoological Survey of India, which unfortunately reached us too late for inclusion in a report prepared by us on the main collection of parasitic nematodes. Fuller descriptions, with figures, will be published later, together with a report on the rest of this material.

Crossocephalus brevicaudatus, sp. n.

Host: Indian rhinoceros (*Rhinoceros indicus*).
Position: stomach.
Locality: Nepal, India.

Three females only. Length 5·3–6·2 mm. Maximum thickness up to 0·4 mm. No cervical papillæ seen, except those on the cuticular collar. Œsophagus 0·945–0·955 mm. long. Excretory pore at 1·22–1·35 mm. from anterior end (buccal armature inverted), connected with an ovoid bladder measuring 0·13 × 0·08 mm. Tail short and blunt, about 0·25 mm. long. Vulva at about 0·13 mm. from anus. Uterus contains 6–8 embryos of various sizes.

This species differs from *C. longicaudatus*, Baylis, already

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[*] Day, Fish. India, p. 338 (1878).